

An adoption of improved varieties of kachri (*Cucumis melo* var. *callosus*) in hot arid region of Rajasthan: An impact assessment

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Abstract

The present study was conducted in all 12 districts of hot arid region of Rajasthan during last 10 years (2007 -2017). These districts were purposively selected for the study as the farmers of these district have adopted the improved variety (AHK-119) of kachri and was grown extensively during kharif/summer season of the year. An extensive study was conducted to assess the impact of adoption of this improved variety and it was found that the average production of the improved variety was 89 q/ha while that of local variety (local check) was 64.0 q/ha. This illustrate that average production of improved variety of kachri (AHK-119) was 39.06 % higher than the production of local one. Per hectare net return from the improved variety of kachri (AHK-119) was 107.35 % higher than the net return achieved from the local variety of kachri. The total area under cultivation of improved variety AHK-119 of kachri in entire hot arid region of Rajasthan was 1277 ha in 2007 which increased to 3865 ha in the year 2017. The gross return from the improved variety of kachri (AHK-119) in entire hot arid region of the Rajasthan was 17.50 corers in 2007 which increased to 52.97 crores in 2017. Likewise the net return from the improved variety of kachri (AHK-119) in entire hot arid region of Rajasthan was 12.88 crores in 2007 which increased to 38.98 corers in 2017 i.e. increased three times in 2017 in comparison to the year 2007. There were observed several progressive farmers who multiplied/produced the seed of improved variety of kachri (AHK-119) under the scientific guidance of the scientist of the Institute (ICAR-CIAH, Bikaner) and sold it @ Rs. 2000 3000 or more per kg to other needy farmers/clients to earn money.

Key words: Adoption, production, improved variety, kachri, impact assessment, hot arid region.

Introduction

The hot arid regions of the India are spread over 32 million ha (0.32 million Sq.Km.) in the state of Rajasthan (61%), Gujarat (20%), Andhra Pradesh (7%), Punjab (5%), Haryana (4%), Karanataka (3%), and Maharashtra(0.4%) which are characterized by hostile agro-climatic conditions and fragile eco-system. As reveals that out of total geographical hot arid area of the country (India), more than 60 % area falls under the state of Rajasthan which spread over arid 12 districts viz., Jaisalmer, Barmer, Bikaner, Churu, Sikar, Jhunjhunu, Naguar, Jodhpur, Pali, Jalor, Sriganganagar, Hanumangarh of the state. In general, the hot arid region of Rajasthan receives very low rainfall, varies from 100 mm annun⁻¹ in north-western district of Jaisalmer to 450 mm per annum in the eastern boundaries of arid district of Rajasthan. The potential evapo-transpiration varies from 2063 mm in Jaisalmer to 1503 mm in Sikar districts of Rajasthan. The rainfall is very erratic and often experienced prolong drought. The ground water table is very deep and often brackish in nature. The extremes of temperature having severe winter during December-January with temperature as low as -4° C and very hot summer during May-June with temperature as high as 48-50 °C is another important characteristic of the hot arid region of Rajasthan. The solar radiation is very high (from 400 Cal cm⁻¹ day⁻¹ in winter to 625 Cal in summer). The wind

velocity in June is very high which leads to heavy wind erosion and formation of sand dunes. Some time strong sand storms of very high speed (60 -70 km h⁻¹) with huge amount of sand particles also occurs. The soils are coarse textured with low silt, clay and humus content and water holding capacity is very low and infiltration rate is very high. The soil fertility is very poor having low organic carbon (0.02-0.06%). Soil salinity, calcareousness and gypsiferous nature of soil add another dimension to these constraints in adoption and production any crops in hot arid regions (Dhadar and Saroj, 2004). Thus, the hot arid region of Rajasthan is full of challenges, threats and constraints which inhabit advancement of the crop production and farming system. However, the hot arid region has been blessed with some of the strength also which disclose the rays of hope and scope of advancement of horticultural development in the region. Aamong such strength, the availability of potential bio-diversity/genetic resources, existence of promising germplasm and drought hardy species of ccucurbitaceous vegetables, etc., are the major strengths which can play vital role in horticultural development in these regions. The cucurbitaceous vegetables are the largest group of vegetables among all vegetables grown in hot arid region of Rajasthan. There were various potential and unique cucurbitaceous vegetables which were grown traditionally and used/consumed widely by the dwellers of the region in

various ways using their own traditional knowledge and methods. Among them, kachri is the most favourite and accepted vegetable among the local people of the arid region of Rajasthan. It is highly drought hardy cucurbitaceous vegetable of the region which is grown there from ancient time. *Kachri*, belongs to the family- *Cucurbitaceae*, genus- *Cucumis*, species- *melo* and var. *callosus/agrestis*. it is mainly grown during the rainy season under the mixed cropping system at large scale or as sole crop at small scale. Some of the farmers who had irrigation facilities grew the *kachri* as sole crop during the summer season also. *Kachri* is the most liked traditional vegetable in hot arid regions where it was utilized/ consumed by > 90 % people as fresh for vegetable purpose and in the forms of various traditionally value added products.

Development of the variety: Considering immense socio-economic importance and industrial potentiality of kachri, ICAR-Central Institute for Arid Horticulture, Bikaner addressed the improvement and scientific cultivation of *Kachri* (*Cucumis melo* var. *callosus* Rott. Cong). The Institute initiated the systematic exploration and research work on improvement of kachri. In 1994, intensive crop specific surveys and explorations were undertaken in hot arid and semi-arid regions of the country and a large number of germplasm (land races, local types and semi-cultivated) of kachri were collected, documented, conserved and potential among the same were evaluated. After an extensive evaluation and hard work, the Institute developed and released a unique improved variety of kachri in 1998 and named as "AHK 119" and disseminated to farmers fields.

The farmers realized the potentiality and beneficial features of this variety (AHK-119) like very early variety, can grown twice in a year (kharif & summer season) with limited water/ soil moisture, high yielding, best suitable in existing harsh climatic conditions, uniform shape, size and colour of the fruits, very good taste and aroma, suitable to prepare the value added products, has long shelf life, high market demand, comparatively high return/ha, etc. and started to grow it on their fields at large commercial scale. The graph of high demand of seeds of this variety hiked year to year. The area and production of the variety increased very fast year to year and continue to increase with increasing rate among large number of farmers. However, it was not crystal clear picture and actual position of adoption/spread, production, productivity, economic return and other impacts of adoption of this improved variety of kachri "AHK-119". Keeping these facts in mind, an intensive impact study was conducted in hot arid regions of Rajasthan with the objective "to assess the impact of adoption of improved variety (AHK-119) of kachri in hot arid region of Rajasthan".

Methodology

The present study was conducted in all 12 districts of hot arid region of Rajasthan during last 10 years (2007 -2017). These districts were purposely selected for the study as the farmers of these districts have adopted the improved variety (AHK-119) of kachri and are growing extensively during each

kharif/summer season of the year. The data and information were collected from multifarious sources/ techniques with the help of semi-structured interview schedule as per objective of the study. The major sources/techniques used to collect the data and information for the study were :

- ✓ Bench mark surveys.
- ✓ Data/information recorded under front line demonstrations on farmer's fields.
- ✓ Interviewing and group discussion with farmers/clients.
- ✓ Discussion and information collected from farmers during different training programmes.
- ✓ Discussion and feed backs recorded from several farmers during the display of technological exhibitions in different farmers' fair and other occasions. .
- ✓ Information/data collected from the line departments and NGOs.
- ✓ Information/data collection from the field workers and secondary sources.
- ✓ Collection of data/information from KVKs of the hot arid region of Rajasthan.
- ✓ Individual online/telephonic discussion and feed backs of the farmers/clients and agencies.
- ✓ Collection of information from seed producing and supplying agencies.
- ✓ Discussion and feed backs from progressive farmers of the in hot arid region of Rajasthan.
- ✓ Collection of information/data from local vegetable markets/mandies, etc.

Thus, the data/information about the adoption, production and spread of the cultivation of improved variety of kachri "AHK-119" were collected extensively from multifarious sources to assess the impact of adoption and production cultivation spread of this improved variety of kachri.. The data and information so collected were compiled, estimated, analyzed and tabulated using the appropriate statistical tools and techniques to draw the inferences/conclusion of the present study. The outcomes/results of the study are being disclosed and cited in details as follows.

Results and discussion

Results and discussions of the outcomes of the study are cited under different heads and subheads as follows.

Comparative economic and yield potential of improved variety (AHK-119) of kachri

A comparative study was carried out to show the production and yield potential of improved variety of kachri over local one. During the study, 100 farmers were selected in each group viz. growing AHK 119 and local kachri. The data/information were collected from both the categories of the farmers and comparison was made between the gross and net return achieved/ha from the improved variety as well as and local variety (local check) of the kachri. It was found that the average production of improved variety of kachri (AHK-119) was 89 q/ha while that of local variety (local check) was 64.0 q/ha only showing there by that average production of

improved variety of kachri (AHK-119) was 39.06 % higher over then local one. The average gross return and net return achieved from the improved variety of kachri (AHK-119) were 137060 and 100860, respectively while the average gross return and net return achieved from the production of local variety (farmers practices) of kachri were 77440 and 48640, respectively (Table 1 and Figure 1). This illustrates that net return achieved from the improved variety of kachri (AHK-119) was 107.35 % higher over the net return achieved from the local variety (local check) of kachri. Similar kind of findings were reported by Balai, *et. al.* (2013).

Adoption and spread in area under the improved variety (AHK-119).

The Institute released the improved variety of kachri (AHK-119) and initiated the work on dissemination and

popularization of the same among the farmers to adopt it. A large number of farmers realized the potentiality and benefits of this variety. Initially, a few farmers adopted and started its cultivation. The popularity of the variety increased very fast among the farming community and demand hiked within 3-4 years of its releasing. The area and production of this variety is continuously increasing year by year. In past, the farmers of the hot arid region of Rajasthan adopted AHK-119 very speedily at large scale and it was calculated that the spread over about 4000 ha area within a few years with large production. The yearly calculation/estimation of the status of spread in area and production of improved variety of kachri (AHK-119) and local one are given in Table 2.

The data in table 2 reveals that the total area under cultivation improved variety (AHK-119) of kachri in entire hot arid region of Rajasthan was 1277 ha in 2007 which

Table 1. Comparative average cost of cultivation, gross and net return (round figures) from production of improved variety (AHK-119) and local variety of kachri.

Particulars/operations	Average cost cultivation involved growing the improved variety (AHK-119) of kachri by 100 farmers (Rs./ha)	Average cost of cultivation in growing the local variety of kachri by 100 farmers (Rs./ha)
Land Preparation	6000	4600
Seed	1600	1500
Fertilizer	7200	4000
Irrigation	2000	1500
Agro Chemicals (including pesticides)	2400	1200
Other labour charges (including harvesting and transportation)	17000	16000
Total cost of cultivation	36200	28800
Kachri production (q/ha)	89	64
Selling price of kachari (Rs/q)*	1540	1210
Gross return from kachari/ha*	137060	77440
Net return from kachari/ha*	100860	48640

*The return/income includes both from fresh as well some value added products of kachri.

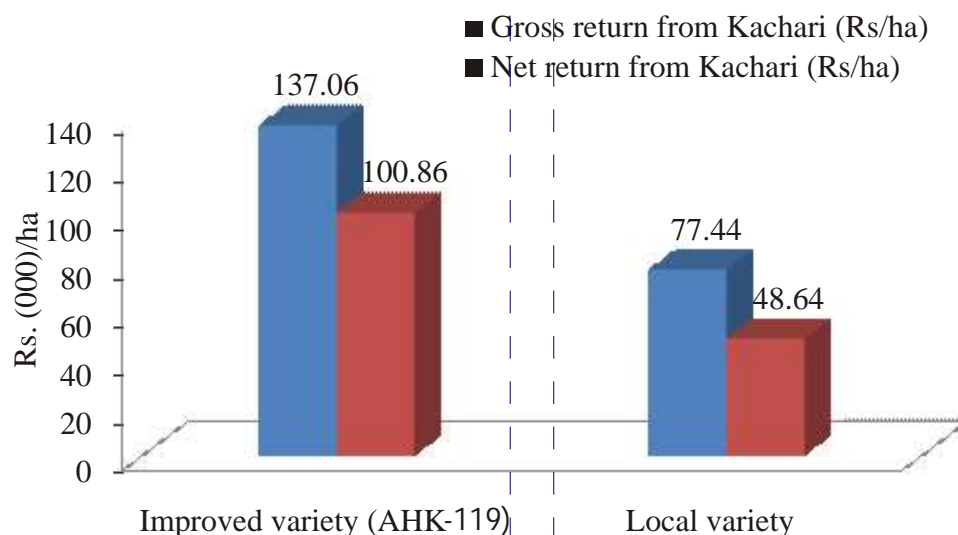


Fig 1: Difference in gross and net returns ('000/Rs./ha) from production of improved variety (AHK-119) and local variety of kachri.

increased to 3865 ha in the year 2017. In case of different district of the hot arid region of Rajasthan, maximum area of improved variety of kachri was under in Bikaner district followed by Nagaur district which increased from 630 to 1720 ha in Bikaner district and from 348 to 1081 in Nagaur districts during the year 2007 to 2017, respectively. The other district where the improved variety of kachri is grown on more than 100 ha of land in 2017 were Jodhpur, Barmer, Sikar and Jhunjhunu. However, the area under this improved variety of kachri was observed fluctuated year to year which might be due to uncertainty in climatic conditions in hot arid region and other factors like erratic and low rainfall, high temperature, frequently occurrence drought and strong sand storms, scarcity of water, low availability of seeds, attack of pests and

diseases, low supply of electricity and canal water, etc.

Gross and net return from the improved variety (AHK-119) of kachri in entire hot arid region of Rajasthan.

On the basis of information/data collected during the study, year wise gross and net return earned from the improved variety (AHK-119) of kachri in entire hot arid region of Rajasthan were analyzed and statistically calculated. The results revealed (Table 3) that the gross return from the improved variety of kachri (AHK-119) in entire hot arid region of the Rajasthan was 17.50 crores in 2007 which increased to 52.97 corers in 2017 i.e. three times increase in last ten years. Likewise the net return from the improved variety in entire hot arid region of Rajasthan was 12.88 corers in 2007 which

Table 2. Year wise area under improved varieties of kachri (AHK-119) in different districts of the hot arid region of Rajasthan (Area in ha.*)

Districts	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Barmer	32	35	36	105	62	92	78	122	103	122	145
Bikaner	630	707	472	1280	1087	1465	1292	1480	1405	1505	1720
Churu	32	23	29	58	52	62	65	80	72	84	96
Sriganganagar	10	10	9	36	28	33	31	35	28	35	41
Hanumangarh	11	10	11	28	25	31	26	36	30	34	46
Jaisalmer	19	18	18	52	68	78	51	68	52	72	86
Jalore	17	21	24	64	59	71	54	71	62	83	85
Jhunjhunu	40	18	20	55	64	74	61	89	78	89	137
Jodhpur	50	37	36	104	94	131	112	152	141	152	181
Nagaur	348	230	267	688	572	774	695	1035	902	925	1081
Pali	39	16	20	42	68	79	52	89	74	92	110
Sikar	48	25	25	78	74	95	80	108	110	122	137
Total area under AHK-119 in hot arid region of Rajasthan	1277	1152	967	2590	2253	2985	2597	3365	3057	3315	3865
% area of the country (India) under AHK-119 in hot arid region of Rajasthan.	62.11	67.17	64.96	64.29	79.25	87.41	87.11	74.69	79.77	85.48	63.44

* Kharif + summer season

Table 3. Year wise total area (ha), production ('000'tons), gross and net income (in Corers) from improved variety of kachri (AHK-119) in hot arid regions of Rajasthan.

Years	Area*	Production	Gross return	Net return
2007	1277	11.37	17.50	12.88
2008	1152	10.25	15.79	11.62
2009	967	8.61	13.25	9.75
2010	2590	23.05	35.50	26.12
2011	2253	20.05	30.88	22.72
2012	2985	26.57	40.91	30.11
2013	2597	23.11	35.59	26.19
2014	3365	29.95	46.12	33.94
2015	3057	27.21	41.90	30.83
2016	3315	29.50	45.44	33.44
2017	3865	34.40	52.97	38.98

* Kharif + summer season both

increased to 38.98 crores in 2017. It implies that the net return of the improved variety of kachri (AHK-119) in entire hot arid region of Rajasthan increased three times in this period. It is also worth to mention here that contribution of the improved variety kachri (AHK-119) in total net return achieved from kachri crops (improved + local) in entire hot arid region of Rajasthan was > 60 % in the year of 2007 which increased > 80 % during the year 2017. Similar findings with respect to net return per hectare and cost benefit ratio were also reported by Jatav, *et. al*, (2016a, 2016b).

Development of seed chain of improved variety of kachri (AHK-119) and income generation.

The area and production of the improved variety of kachri (AHK-119) increased rapidly in hot arid region of Rajasthan. The major reason behind fast increasing in area and production in the region was development of seed production chain of the variety among the farmers. Initially, the farmers purchased the seeds of improved variety of kachri (AHK-119) from the Institute (ICAR-CIAH, Bikaner) and multiplied the same on their own fields under the technical guidance of scientists of the Institute and used it to grow on their own fields in next season/year or sold out the surplus seed to their fellow farmers/ shopkeepers to earn money. Several progressive farmers who multiplied /produced the seed of improved variety of kachri (AHK-119) on their own level each upto extent of 10-30 kg/season under the scientific guidance of the experts and sold it (@ Rs. 2000-3000 or more per kg) to other needy farmers/clients to earn money. As the demand of seeds of this improved variety (AHK-119) is very high among the farmers of the hot arid regions, hence, several progressive farmers have made their profession to multiply/produce seeds of this variety to earn in considerable amount of money. The trend of such multiplication of the seeds of improved variety of kachri (AHK-119) is increasing year to year which is encouraging more and more spread of this variety in hot arid region of Rajasthan. These findings are in the line of the findings reported by Meena *et. al*. 2016 in their study.

Constraints in adoption and production of improved variety (AHK-119) of kachri at large scale in hot arid region of Rajasthan.

Despite the apparent need and advantages associated with adoption and production of improved variety (AHK-119) of kachri at large scale in hot arid region of Rajasthan, the farmers were not much success in adoption and production/growing of the improved variety of kachri on their fields in harsh climatic conditions of the region. They had to face various “problems/ constraints” which led to low/ non adoption of these crops at large scale in hot arid climatic conditions of the hot arid region of the Western Rajasthan. Major general constraints observed during the study which hinder the adoption and production of improved variety of kachri at large scale in hot arid regions of western Rajasthan India were as follows.

(I) Ecological constraints.

The major observed ecological constraints which

affect the large adoption and production of improved variety of kachri at large scale in hot arid region of Rajasthan were as follows.

- Acute shortage of water
- Poor and erratic rainfall
- Occurrence of drought and famine very frequently.
- Very deep and salty/brackish ground water
- Extremes of temperature during summer (upto 50°C)
- Perpetuation of high hot winds and sand storms
- Shifting of sand and sand dunes
- High evapo-transpiration and low relative humidity
- Poor soil with low water retention capacity.

(ii) Socio-psychological constraints.

During the study there were observed various socio-psychological and cognitive constraints also which led to low or non adoption and production/growing the improved variety of kachri at large scale in hot arid regions of Rajasthan which were as follows.

- Lack of awareness, interest and knowledge
- Deep faith in traditional cropping system
- Lack of reciprocal technical interactions between scientists and farmers.
- Lack of technical - social institutions
- Predominance of myths and misunderstandings
- Illiteracy and heterophilic population
- Fear of crop failure
- Dissonance about the success of crops/technologies
- Lackadaisicalness in farmers and lack of inspirations/motivations.

(iii) Techno-economic constraints.

Techno-economic constraints which were responsible in low or non adoption and production of improved variety of kachri at large scale in hot arid region were as below.

- Low/non accessibility of seeds of improved variety of at local level as per desire.
- Non availability technical guidance and reliable inputs at local level.
- Lack of awareness and knowledge improved production technologies of kachri
- Lack of local markets/*mandies* to sell the produces/products of kachri.
- Poverty, scarce resources and low risk bearing capacity of the farmers.
- Perishable nature of the produces / products.
- No standard technologies for value addition of fruits of kachri.
- Lack of subsidy/credit facilities to support to the farmers.
- The commercial production front of kachri is lagging behind
- No security and support against crop failure and low

income
Monopoly of brokers in selling/purchasing produces/products.

(iv) Constraints related to essential infrastructural facilities.

There were observed some infrastructural constraints also which were considered responsible for low adoption of the improved variety of kachri in hot arid region were as follows.

- Lack of reliable sources of technical information and inputs.
- Poor extension and communication system
- Lack of the specific facilities for farmers' trainings and skill development.
- Poor networking on modern/improved production technologies of kachri.
- Lack of safe storage / preservation facilities.
- Limited and irregular supply of electricity
- Unfamiliar and long distance of research and extension institutions.
- Absence of regulated local markets and transportation facilities.

From the foregoing account, it can be argued that if quality seed of AHK-119, scientific method of cultivation, proper marketing system, sufficient storage, post harvest management and value addition techniques/facilities are made available, definitely the prospect of production of this variety will be bright in hot arid regions of the country. For further boost up of the adoption and production of improved variety of kachri at large commercial scale in regions, the farmers should be encouraged and facilitated to grow it on more and more areas. The wider publicity and popularity of the improved

variety (AHK-119) of kachri should be ensured among the farmers/clients through organizing different extension programmes and activities. There were observed some constraints also which impede the fast adoption and spread of this variety in hot arid region. These constraints should be eradicated through creating proper strategic plan and scientific management practices.

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